YOLO COUNTY PROJECT XL BIOREACTOR LANDFILL PROPOSAL

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MAKE NO LITTLE PLANS

Make no little plans;
They have no magic to stir anyone's blood
And probably themselves
Will not be realized.

Make big plans;
Aim high in hope and work,
Remembering that a noble, logical diagram
Once recorded will not Die.

BY Daniel H. Burnham

Background

- ✓ Bioreactors -- landfills operated to achieve rapid transformation and stabilization of organic wastes
- ✓ Issues of insterest --
  - Leachate quality, ground-water protection, LF capacity
  - Regulatory issues
  - Landfill gas emissions (e.g., methane, NMVOCs)

Background

- ✓ *Description of the Yolo County Central Landfill*
- ✓ *Landfill Bioreactor Project*
  - *Project Objectives*
  - *Current Bioreactor History & Funding*
  - *Construction and Filling*
  - *Landfill Gas Collection and Measurement*
  - *Instrumentation*
  - *Liquid Addition and Leachate Recirculation*
- ✓ *Project Results*

Background

- ✓ Description of Yolo County Central Landfill
  - **Current Design Capacity, 25 million C.Y.**
  - **Current Operating life**
    - **Opened 1975**
    - **Planned closure 2021**
  - **Containment system - single composite liner, leachate collection and removal system**
  - **Landfill gas collection system**
  - **Waste characteristics (Residential and Commercial Waste)**

Background

✓Project Objectives

- *Substantially Accelerate Landfill Gas Generation and Maximize Gas Capture*
- *Monitor Biological Conditions Within the Landfill*
- *Estimate the Potential for Landfill Life Extension*
- *Provide Interested Parties & Regulatory Agencies with Information on the Technology*
- *Better Understand the Movement of Moisture in the Landfill*
- *Assess the Performance of Shredded Tires for Landfill Gas Transfer*

Background

- ✓CONSTRUCTION PHASE SUPPORT
  - California Energy Commission; $250,000
  - Yolo County , $125,000
  - Sacramento County, $125,000
  - California Integrated Waste Management Board, $63,000
  - TOTAL PROJECT COST $563,000

Background

- ✓MONITOING PHASE SUPPORT (2 YRS)
  - *Western Regional Biomass Energy Program (USDOE), $50,000*
  - *Urban Consortium Energy Task Force (USDOE), $110,000*
  - *Yolo County, $115,000*
  - *TOTAL PROJECT COST $275,000*

Background

✓BASIC FEATURES OF THE PROJECT

- ***Two Test Cells (Control & Enhanced)***
- ***Base Layer Containment, Sub. Title D***
- ***Leak Detection System, Double Liner***
- ***Compacted Clay Sidewalls***
- ***Municipal Solid Waste***
- ***Instrumentation in Waste Mass***
- ***Gas and Liquid Collection and Measurement***
- ***Leachate Injection System***
- ***Final Cap System (LLDPE)***

Background

✓ *DEMONSTRATION CELLS CONSTRUCTION DATA SUMMARY*

	CONTROL CELL	ENHANCED CELL
CELL FOOT PRINT (ACRES)	0.27	0.27
WASTE AVERAGE DEPTH (FEET)	43	40
SOLID WASTE (TONS)	8,737	8,568
ALTERNATIVE DAILY COVER GREEN WASTE (TONS)	1,454	1,336
IN PLACE WASTE COMPACTION (POUNDS PER C.Y.)	1,014	1,027
WASTE TIRES USED (TONS)	200	295

Background

- ✓ OPERATIONS & MONITORING PROGRAM WORK PLAN
  - *Addition of Liquid to Enhanced Cell*
  - *Liquid Volumes*
  - *Leachate Depth*
  - *Leachate Composition*
  - *Waste Moisture Condition*
  - *Waste Temperature*
  - *Landfill Gas Production*
  - *Landfill Gas Composition*
  - *Landfill Gas Pressures*
  - *Landfill Settlement*
  - *Data Analysis and Interpretation*

Background

✓ *DEMONSTRATION CELL SLIDE SHOW*

Background

✓ *DEMONSTRATION CELLS AVERAGE WASTE TEMPERATURE*

YEAR	1997	1998	1999-May
ENHANCED CELL AVERAGE WASTE TEMPERATURE (LEVEL 1)	90 ° F	93 ° F	91 ° F
CONTROL CELL AVERAGE WASTE TEMPERATURE (LEVEL 1)	79 ° F	79 ° F	79 ° F
ENHANCED CELL AVERAGE WASTE TEMPERATURE (LEVEL 2)	109 ° F	109 ° F	108 ° F
CONTROL CELL AVERAGE WASTE TEMPERATURE (LEVEL 2)	99 ° F	95 ° F	91 ° F
ENHANCED CELL AVERAGE WASTE TEMPERATURE (LEVEL 3)	104 ° F	109 ° F	106 ° F
CONTROL CELL AVERAGE WASTE TEMPERATURE (LEVEL 3)	99 ° F	95 ° F	90 ° F

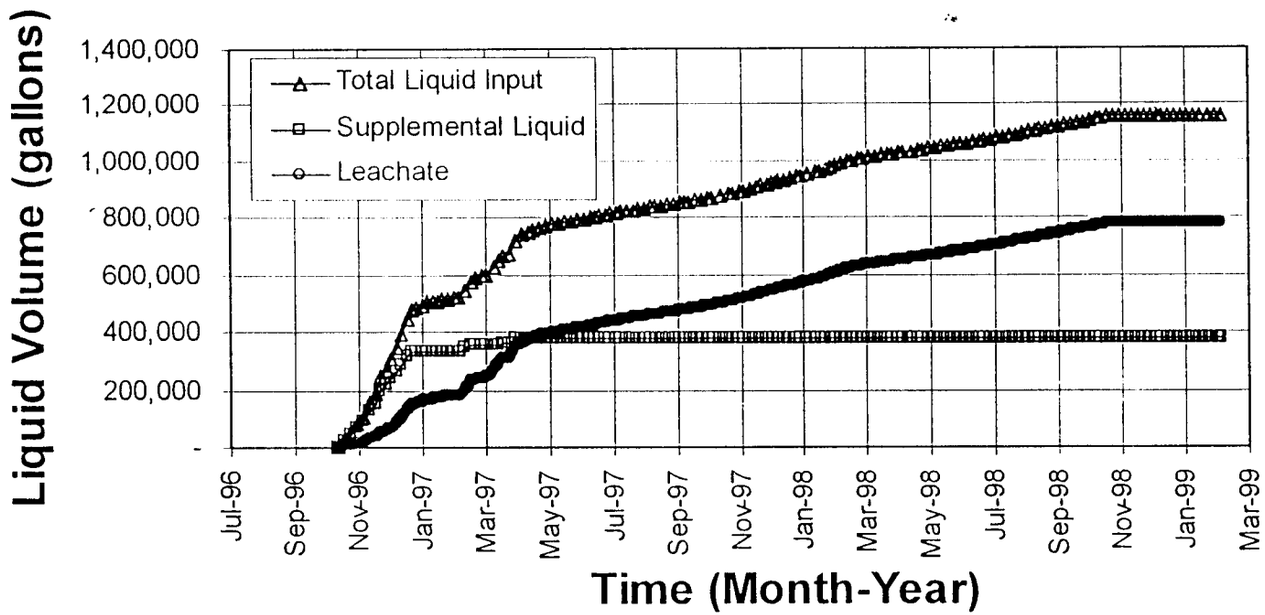
Background

✓LIQUID ADDITION DATA SUMMARY

- *Started Liquid Addition on October 23, 1996*
- *Total Amount of Liquid Added =1,159,616 Gallons (Groundwater and Leachate)*
- *Total Amount of Groundwater Added =377,690 Gallons*
- *Total Amount of Leachate Recirculated =781,926 Gallons (Leachate was Recirculated until November 15, 1998)*
- *All Groundwater Added has been Absorbed*
- *No Liquid Draining Out of Enhanced Cell -July 2, 1999*
- *"Apparent" Minimum Field Capacity of Dry Waste Weight 48%*
  (Assumes 20% Moisture for As-Placed Waste)

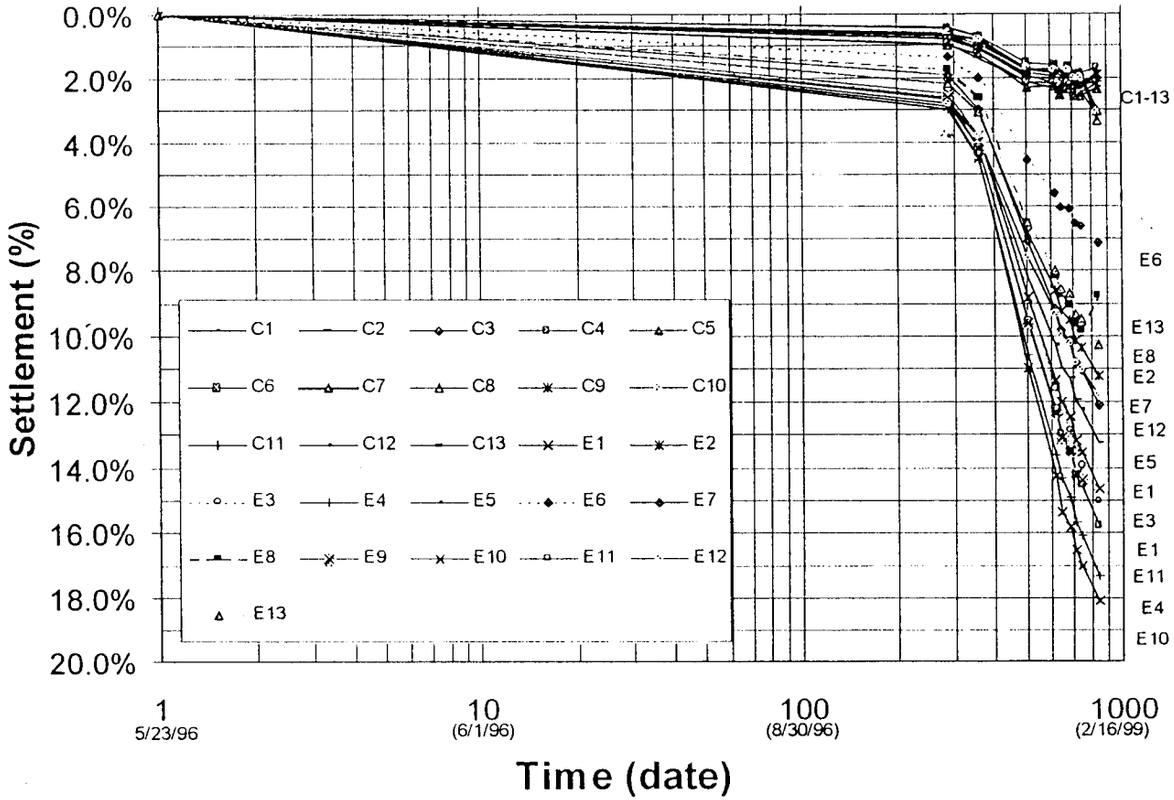
Background

✓ *Cumulative Liquid Volumes Versus Time*



Background

✓ *SETTLEMENT DATA FOR CONTROL & ENHANCED CELLS*



Background

✓ *AVERAGE SETTLEMENT FOR DEMONSTRATION CELLS*

YEAR	1998	1999-MAY
ENHANCED CELL AVERAGE SETTLEMENT	17 Inches	67 Inches
CONTROL CELL AVERAGE SETTLEMENT	5 Inches	10 Inches

Background

✓ *LEACHATE CHEMISTRY FOR ENHANCED CELL*

YEAR	1996	1997	1998	1999
PH	5.8	7.0	7.2	7.2
BOD (mg O/L)	5,020	820	140	80
COD (mg O/L)	20,300	2,860	3,130	2,650
TDS (mg/L)	19,800	7,600	7,500	7,250
TOC (mg/L)	9,830	611	1,130	1,080
Iron (mg/L)	152,000	933	504	206
Manganese (µg/L)	41,900	4,000	1,170	1,060
Calcium (mg/L)	1,400	480	220	198
Toluene (µg/L)	160	75	24	15

Background

✓ *LEACHATE CHEMISTRY FOR CONTROL CELL*

YEAR	1996	1997	1998
PH	7.8	8.5	8.6
BOD (mg O/L)	-	67	20
COD (mg O/L)	98	80	93
TDS (mg/L)	2,740	2,760	2,440
TOC (mg/L)	23	26	26
Iron (mg/L)	95	83	216
Manganese (µg/L)	208	115	149
Calcium (mg/L)	45	19	31
Toluene (µg/L)	-	-	-

Background

✓ *LANDFILL GAS DATA FOR ENHANCED & CONTROL CELL*

YEAR	1997	1998	1999-May
ENHANCED CELL LFG VOLUME (Million SCF)	12.2	24.8	30.7
CONTROL CELL LFG VOLUME (Million SCF)	9	14.9	15.2
ENHANCED CELL AVERAGE FLOWRATE (SCFM)	35	22	7
CONTROL CELL AVERAGE FLOWRATE (SCFM)	22	5	1
ENHANCED CELL AVERAGE METHANE CONTENT	53%	54%	53%
CONTROL CELL AVERAGE METHANE CONTENT	47%	45%	47%

Project XL Proposal

- ✓ Full-scale demonstration of bioreactor concept
  - accelerate CH_4 production and improve energy recovery
  - verify improvement in leachate quality within 10-year timeframe
  - accelerate stabilization of waste mass
  - reduce post-closure risk and cost
  - verify hydraulic head on the liner

Project XL Proposal

- ✓ Project elements
  - use of liquid amendments (septic waste, sewage sludge, food processing waste)
  - use of single composite liner (rather than double composite liner)
  - Use alternative cover (for daily and intermediate cover) instead of soil
  - Operate project in two modes -- anaerobic and aerobic

Project XL Proposal

✓Flexibility and other benefits

- Improved landfill gas-to-energy economics
- Reduced leachate disposal costs
- Reduced containment system costs (single vs double composite liner)
- Reduced post-closure care costs
- Delay placement of final cap system to allow for placement of more waste and future settlement
- Use alternative cover (for daily and intermediate cover) instead of soil
- Operate project anaerobically and aerobically
- Credit towards state 50% waste reduction requirement (Cal AB 939)

Project XL Proposal

- ✓Feasibility
  - Technical capability is well-developed
  - Results to date are highly positive
  - Potential for significant cost savings, revenue, and improved environmental acceptance
  - CA participation is critical

Project XL Proposal

- ✓Requested Flexibility
  - Less stringent liner system-single composite rather than double
  - Liquids application
  - Operate project anaerobically or aerobically-after the anaerobic phase, operate cell aerobically to reduce volume

Next Steps

- ✓ Develop XL proposal for Yolo County Landfill
  - resolve issues
  - stakeholders participation & comments